Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Department of Environmental Protection

Bureau of Waste Prevention
Business Compliance Division

Background Information Document
And
Proposed Amendments to 310 CMR 7.00 et seq.
Regulations for the Control of Air Pollution in the
Berkshire Air Pollution Control District
Pioneer Valley Air Pollution Control District
Merrimack Valley Air Pollution Control District
Metropolitan Boston Air Pollution Control District
Central Massachusetts Air Pollution Control District
Southeastern Massachusetts Air Pollution Control District

For Public Comment and Hearings

Engines and Combustion Turbines
Combined Heat and Power

Regulatory Authority:
M.G.L. Chapter 111, §§ 142A through 142N;
c.21§§ 26 through 53; c.21A§§2, 13 and 16; and c.21C

March 2008

I. Background

In a combined heat and power (CHP) system, the engine or combustion turbine is connected to an electrical generator for electrical power production. The hot exhaust gasses from the engine or combustion turbine are directed through a heat recovery system, such as a boiler, to recover thermal energy for use in heating, cooling, or other uses. This approach eliminates the need for a second combustion unit and therefore eliminates the emissions such a combustion unit would produce. CHP systems make more efficient use of fuel, such as natural gas or fuel oil, than two, separate stand alone, combustion units, one for electricity and one for thermal energy such as steam thus reducing the net emissions of greenhouse gas and other air contaminants.

The Massachusetts Department of Environmental Protection (the Department), Bureau of Waste Prevention, is proposing additions and revisions to the Department's Air Pollution Control Regulations (310 CMR 7.00) to encourage the installation of CHP systems. These regulations will reduce greenhouse gas and other emissions, reduce fossil fuel usage and enable cost savings. Several states have adopted regulations that provide an emission adjustment to encourage CHP installations.[1]

In 2004, when the Department's regulations for engines and turbines (310 CMR 7.26(40)-(44)) were developed, the Department relied on the approach recommended by the Regulatory Assistance Project (RAP) in its "Model Rule for the Output Specified Air Emissions from Smaller-Scale Electric Generation Resources"(RAP Model Rule).[2] The Department's regulations, adopted in 2005, established emission limitations for engines or combustion turbines without regard to whether the engine or combustion turbine is used for electricity generation, direct power application, or is part of a CHP system.

The RAP Model Rule (www.raponline.org) also established a methodology that enables the applicant to adjust the emission limitation for a CHP system and take into account emissions that will not be created by omitting a conventional separate system (e.g. boiler) to generate the same thermal output. In 2004, the Department requested comment on the appropriateness of applying the RAP Model Rule procedure. Many comments were received in support of regulations that will allow adjustment to emission limits for CHP systems as a way to promote increased energy efficiency and provide correspondingly lower emissions.

The Department is now proposing to allow a procedure consistent with the RAP methodology that will provide adjustment to the emission limitation required in a CHP project in recognition of the "dual" usage of the fuel consumed by the engine or combustion turbine.

[1] For more information, the reader is directed to the U.S. Environmental Protection Agency web site on CHP (www.epa.gov/chp).

[2] This rule development effort, completed in the fall of 2002, was a cooperative effort of state energy and environmental regulators, industry representatives, environmental advocates, and federal officials. See www.raponline.org.

II. Purpose of the Proposed Regulations

These regulations will further encourage the development of CHP projects in Massachusetts. CHP systems make more efficient use of fuel and thereby reduce Greenhouse Gas emissions. Because of ground level ozone non-attainment concerns in Massachusetts, the proposal contains safeguards that will not allow more oxides of nitrogen (NOx) emissions than would have occurred without the installation of CHP systems.

III. Summary of Proposed Regulations

A new section to the Air Pollution Control Regulations, 310 CMR 7.26(45), is proposed for CHP projects. This proposal will provide an adjustment to CHP emission limits, hereafter referred to in this document and the proposed regulations as "emission credits." Emission credits are intended to encourage facilities contemplating installation of electricity generating engines or combustion turbines to install CHP systems. This proposal will encourage new facilities to capture and use heat from the electrical generating equipment and avoid the installation of a new boiler, or will allow facilities to shut down or curtail operation of an existing, inefficient boiler. In effect, the proposal will allow a facility to obtain "credit" for the emissions that would have occurred if a separate new boiler was installed with the engine or combustion turbine, or that would have occurred from a boiler that was not being replaced.

The proposal sets forth eligibility requirements, limits applicability to non-power plant size combustion turbines, provides upper boundary emission rates to be used in determining credits, and uses the Department's preconstruction review and approval regulations at 7.02(5) to implement the regulatory requirements. Revisions to 310 CMR 7.02(5)(a)3.b., 310 CMR 7.26(41), and 310 CMR 7.26(43)(a) are proposed to aid in the implementation of these requirements.

Emission credits are determined by a formula in the proposal. The formula translates the emissions per thermal energy unit from the boiler that is replaced, or not installed, into emissions per megawatt hour, and the avoided emissions are credited toward the permitted emissions of the engine or combustion turbine, in pounds per megawatt hour. The emission credit is added to the applicable emission limitation for an engine or combustion turbine as contained in existing 310 CMR 7.26(43) Tables 2, 3, or 4 to set the emission limitation for the CHP system.

The emission credit will mean that while the engine or combustion turbine in the CHP system burns fuel and generates emissions, the CHP system is allowed to emit a higher rate, for instance, of NOx than a stand alone engine or combustion turbine, in recognition of the fact that that no separate boiler emissions occur. In most cases, this will result in less expensive NOx emission controls, or no add-on emission controls, on the engine or combustion turbine, which means lower capital and operating costs.

For example, if a combustion turbine were allowed to emit 0.14 lbs/MW-hr NOx, and a separate boiler would have been allowed to emit 0.17 lbs/MW-hr NOx (emission rate as adjusted by the formula), the CHP would be allowed to emit up to 0.31 lbs/MW-hr

The Department has included a "fail safe" provision in the proposal applicable to NOx emissions in recognition of the Commonwealth's ozone non-attainment status. The "fail safe" provision will limit the total NOx emissions from a CHP system to no more than the total emissions of separate systems producing the same electrical and thermal outputs.

For example, if a combustion turbine and a separate a boiler would have been allowed to emit a total of total 12 tons per year of NOx, the CHP system with the same maximum electrical and thermal outputs would not be allowed to emit more than that amount.

Each CHP project will have differing electrical and thermal needs. New facilities will avoid installation of a new boiler, whereas an existing facility will be shutting down or curtailing operation of an existing boiler. These variables will require case-by-case analysis to determine the amount of emission credits, the resulting necessary air pollution controls, and the need to invoke the "fail safe" provision for each CHP project.

In practice, the emission credits will be proposed by a project proponent, be reviewed by the Department, and then codified in an approval issued under 310 CMR 7.02. The CHP project will be required to test emissions of the new system upon start-up, and periodically thereafter. To ensure compliance with the approved emissions standards, the tested emission level must not exceed the sum of the emission credits plus the applicable emission limitation for the engine or combustion turbine contained in existing 310 CMR 7.26(43) Tables 2, 3, or 4.

IV. Air Quality Impacts

The Department expects that the proposed regulations will have a positive impact upon air quality, mainly in the form of reductions in greenhouse gas emissions as less fuel is consumed to produce the same electrical and thermal energy outputs in a CHP system as compared to separate systems.

Most CHP projects consist of combustion turbines for electric power production and heat recovery steam generators for heat recovery from the turbine exhaust. Combustion turbines are typically fueled with natural gas, that as a lower carbon content fuel than liquid or solid fossil fuels, further lowers greenhouse gas emissions.

Natural gas contains only trace levels of sulfur. Any natural gas fueled CHP system that replaces an existing liquid fueled boiler will have reductions of sulfur dioxide emissions and also reductions of secondary particulates formed from sulfur containing compounds. Oxides of nitrogen emissions, a summertime ground level ozone concern, are limited by a fail safe provision in the regulation to no greater emissions allowed than what two identical separate units (combustion turbine and boiler) would emit.

There are other emission benefits that occur that are difficult to quantify. For instance, by generating electricity at the site of use, electrical grid transmission line losses are avoided. Less fuel needs to be burned "globally" and therefore less contamination of the atmosphere occurs.

V. Savings Clause

Any regulatory amendments that affect regulations and programs that are part of the Massachusetts State Implementation Plan (SIP) must demonstrate that they are no less stringent than the existing SIP and that any projected increases in emissions that result from the amendments are offset by equal or greater predicted emission decreases. The fail safe provisions of the proposal for the non-attainment air contaminant NOx, limits emission credits to levels no greater than what would have been allowed from two separate combustion systems.

As there are no emission increases or adverse air quality impacts projected as a result of these proposed amendments, there are no compensatory emission decreases that need to be made.

VI. Economic Impacts

The anticipated economic impacts from this proposal can be divided into two categories: administrative costs to the Commonwealth and costs for those who own/operate engines and turbines.

The Department will need to review individual applications that companies will need to prepare and for which they must pay permit review fees. Because standards are set in the regulations, companies have certainty regarding what is required and can implement CHP projects more quickly thus saving time and money. The Department's review of applications will be less time intensive because emission requirements are specified.

These regulations are designed to further encourage installation of CHP systems. While new CHP systems will incur capital costs for installation, companies installing CHP systems will realize reductions in electricity and fuel costs.

VII. Impact on Small Business

The impacts upon small business are the same as detailed above.

VIII. Agricultural Impacts

Pursuant to the intent of Massachusetts General Laws, Chapter 30A, Section 18, state agencies should evaluate the impact of proposed programs on agricultural resources within the Commonwealth.

As there are no air quality impacts or emission increases associated with these amendments, the proposed amendments are not expected to have any impact on agricultural production in Massachusetts.

IX. Toxics Use Reduction

Implementation of toxics use reduction is a Department-wide priority. Toxics use reduction is defined as in-plant practices that reduce or eliminate the total mass of contaminants discharged to the environment. These proposed regulations are not expected to impact the Departments efforts.

X. Impacts on Cities and Towns

Pursuant to Executive Order 145, the Department must assess the fiscal impact of new regulations on the Commonwealth's municipalities. The Executive Order was issued in response to Proposition 2 ½.

These regulations do not require that communities install CHP systems. Should a community install a CHP system the requirements will result in the positive benefits as outlined above.

XI. MEPA

This proposed action is "categorically exempt" from the "Regulations Governing the Preparation of Environmental Impact Reports", 301 CMR 11.00, because the proposed amendments will not result in an overall increase in emissions. All reasonable measures have been taken to minimize adverse impacts. Although the rate of NOx emissions allowed from a combustion turbine in a CHP system may be greater than from a stand alone combustion turbine, total NOx emissions are limited by the fail safe provision in the regulation to no greater emissions than what two identical separate units (CT and boiler) would emit.

See Section IV. Air Quality Impacts.

XII. Request For Comments

Comments on these proposed regulations should be sent to:

Mr. Robert T. Donaldson, Associate Director
Business Compliance Division
Bureau of Waste Prevention
Department of Environmental Protection
One Winter Street Seventh Floor
Boston, Massachusetts 02108

XIII. PUBLIC PARTICIPATION

In developing these amendments, the Department has consulted with other northeastern states air pollution control agencies, the engine and turbine manufacturing industry, the environmental community, and proponents of distributed electrical and mechanical power.

These proposed regulations will be subject to further public review and comment prior to promulgation. Public hearings to collect comments on the proposed amendments will be conducted under the provisions of Chapter 30A of the Massachusetts General Laws on:

April 30, 2008 at 10:00 a.m.	May 1, 2008 at 10:00 a.m.
Springfield City Hall	MassDEP - Boston Office
Room 220	2nd Floor - Commonwealth Room
36 Court Street	One Winter Street
Springfield, MA	Boston, MA

Testimony may be presented orally or in writing at the public hearings. Written comments will be accepted until 5pm Eastern Standard Time on May 12, 2008 at the Business Compliance Division, Department of Environmental Protection, One Winter Street, 7th Floor, Boston, MA 02108.

After public review and Department evaluation and response to comments, the final amendments will be submitted to the Secretary of State for promulgation. The amendments will also be submitted to the US Environmental Protection Agency for approval as a revision to the Massachusetts State Implementation Plan.

If there are any questions regarding the proposed amendments or this document, please contact Bob Donaldson at (617) 292-5619.

Amend 310 CMR 7.02(5)(a)3.b. to read as follows:

b. Any individual internal combustion engine, such as a stationary combustion turbine or a stationary reciprocating engine, installed on or after March 23, 2006 shall comply with the requirements of 310 CMR 7.26(40) through (45), Engines and Combustion Turbines, except as provided by 310 CMR 7.26(42)(a)1., 310 CMR 7.26(43)(a)2., 310 CMR 7.26(43)(a)3., and 310 CMR 7.26(45)(a)3.

Amend 310 CMR 7.26(41) Definitions. with the addition of the following:

Combined Heat and Power and CHP means a system consisting of an engine or turbine in combination with a heat recovery system such as a boiler that sequentially produces both electric power and thermal energy for use.

Design System Efficiency means the sum of the full load design thermal output and electric output divided by the heat input, all in consistent units of measurement.

Power-to-Heat Ratio means the design electrical output divided by the design-recovered thermal output in consistent units of measurement.

Amend 310 CMR 7.26(43)(a) with the addition of new subsection:

4. On and after (three months after effective date), any owner/operator who constructs, substantially reconstructs or alters an engine or turbine that is part of a combined heat and power system, may satisfy 310 CMR 7.26(43)(b) by complying with the requirements of 310 CMR 7.26(45).

Amend 310 CMR 7.26 with the addition of new section:

(45) Combined Heat and Power (CHP) The purpose of 310 CMR 7.26(45) is to encourage the installation of CHP systems. A methodology is set forth whereby emission credits are utilized in determining compliance of a CHP installation with the emission limitations contained in 310 CMR 7.26(43)(b).

(a) Eligibility CHP installations shall meet the following requirements to be eligible for emission credits related to thermal output:

1. The power-to-heat ratio must be between 4.0 and 0.15.
2. The design system efficiency must be at least 55 percent.
3. The CHP project must comply with the requirements of 310 CMR 7.02(5)(c).
4. The engine has a rated power output equal to or greater than 50 kW or the turbine has a rated power output less than or equal to ten MW.

(b) Emission Credits A CHP system that meets these requirement may receive a compliance credit against its actual emissions based on the emissions that would have been created by a conventional separate system used to generate the same thermal output. The credit will be subtracted from the actual CHP system emissions for the purpose of calculating compliance with the emission limitations contained in 310 CMR 7.26(43)(b). The credit will be calculated according to the following assumptions and procedures:

1. The emission rates for the displaced thermal system (*e.g.* boiler) will be:
    a. For CHP installed in new facilities, the emissions limits applicable to new natural gas-fired boilers in 310 CMR 7.26(33) in lb/MMBtu.
    b. For CHP systems that replace existing thermal systems for which historic emission rates can be documented, the historic emission rates in lbs/MMBtu, but not more than:

Emissions	Maximum Rate
Nitrogen oxides	0.3 lbs/MMBtu
Carbon monoxide	0.08 lbs/MMBtu
Carbon dioxide	117 lbs/MMbtu

2. The emission rate of the thermal system in lbs/MMBtu will be converted to an output-based rate by dividing by the thermal system efficiency. For new systems, the efficiency of the avoided thermal system will be assumed to be 80% for boilers or the design efficiency of other process heat systems. If the design efficiency of the other process heat system cannot be documented, an efficiency of 80%will be assumed. For retrofit systems, the historic efficiency of the displaced thermal system can be used if that efficiency can be documented and if the displaced thermal system is enforceably shut

down and replaced by the CHP system, or if its operation is measureably and enforceably reduced by the operation of the CHP system.

3. The emissions per MMBtu of thermal energy output will be converted to emissions per MWh of thermal energy by multiplying by 3.412 $MMBtu/MWh_{thermal.}$
4. The emissions credits in $lbs/MWh_{thermal}$, as calculated in 310 CMR 7.26(45)(b)3., will be converted to emissions in $lbs/MWh_{emissions}$ by dividing by the CHP system power-to-heat ratio.
5. The credit, as calculated in 310 CMR 7.26(45)(b)4., will be subtracted from the actual emission rate of the CHP system to produce the emission rate for compliance purposes.
6. The mathematical calculations set forth in 310 CMR 7.26(45)(b)1. through 4. are expressed in the following formula:

$$\text{Credit lbs/MWh}_{\text{emissions}} = \frac{\text{(boiler limit lbs/MMBtu)}}{\text{(boiler efficiency)}} \times \frac{\text{3.412 MMBtu/MW}_{\text{thermal}}}{\text{(power-to-heat ratio)}}$$

7. Emissions determined by this methodology for comparison with the emission limitations set forth in 310 CMR 7.26(43)(b) shall satisfy the requirements of 310 CMR 7.02(8)(a)2.
8. The amount of credit allowed for oxides of nitrogen shall be limited such that total emissions from the CHP system shall be no greater than the sum of emissions from two separate systems producing the amount of electrical and thermal output.

(c) Duct Burners Emissions from duct burners installed in a CHP system shall comply with the emission limitations contained in 310 CMR 7.26(33).